Association between chronic conditions and perceived unmet health care needs

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ABSTRACT

Background: Although effective treatments exist, many Canadians with chronic medical conditions do not receive the full care they require, possibly as a consequence of limited accessibility or availability. A commonly used indicator of inadequate access to or availability of care is the perception of unmet health care needs. The objective of this study was therefore to determine the association between chronic conditions and perceived unmet health care needs.

Methods: We extracted data for adult respondents from the combined 2001, 2003 and 2005 cross-sectional cycles of the Canadian Community Health Survey. Multivariate logistic regression was used to estimate the association between 7 high-prevalence and high-impact chronic conditions (arthritis, chronic obstructive pulmonary disease/emphysema, diabetes, heart disease, hypertension, mood disorder and stroke) and perceived unmet health care needs in the prior 12 months, adjusting for sociodemographic variables, health behaviours, health status and survey cycle.

Results: Of the 360 105 adult respondents, 12.2% reported an unmet health care need. Compared with those without chronic conditions, respondents with at least one condition were more likely to report an unmet need (adjusted odds ratio [OR] 1.51, 95% confidence interval [CI] 1.45–1.59). Those with mood disorders were almost twice as likely to report an unmet need (OR 1.94, 95% CI 1.78–2.12), while those with diabetes or hypertension were less likely to report an unmet need (diabetes OR 0.85, 95% CI 0.76–0.94; hypertension OR 0.96, 95% CI 0.89–1.04). Furthermore, the likelihood of an unmet need increased with the number of chronic conditions (OR 1.71, 95% CI 1.56–1.88 for 3 or more conditions). Respondents with chronic conditions were more likely than those without to report an unmet need related to resource availability (OR 1.14, 95% CI 1.06–1.22).

Interpretation: Adults with chronic medical conditions are more likely to report an unmet health care need, and the likelihood increases with an increasing number of conditions. Whether these unmet needs are associated with worse outcomes, and whether interventions targeted to address these needs may improve outcomes for Canadians with chronic disease, remain to be determined.

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➤ THE ECONOMIC AND HEALTH IMPACT OF CHRONIC medical conditions is a major concern in Canada and abroad.[1–6] Approximately 1 in 3 Canadians has 1 or more chronic conditions, including diabetes, hypertension, arthritis and heart disease,[1,4,7] and the direct cost associated with management of these conditions exceeds $40 billion annually.[5] Furthermore, people with chronic conditions use a disproportionate amount of health care resources compared with those with no long-term health problems.[1,3] This economic burden is further magnified among subjects with multiple chronic conditions, with health resource use and associated costs increasing with the number of conditions present.[8]

Consequently, improving care for respondents with chronic disease has become a major focus.[9–14] Disease management programs, disease-specific treatments and patient education efforts have been developed to prevent disease progression and to improve management.[10,12] Despite the availability of such resources, many Canadians still do not receive the full care required for management of their long-term medical conditions.[15,16] Approximately 1 in 3 Canadians with diabetes reports not having undergone recommended tests for effective diabetes care,[17] and 1 in 5 adults with hypertension has not received treatment for blood pressure control.[18] Lack of care may be related to a number of factors, including limited accessibility or other potential barriers to care. It may also be related to personal choice and to expectations of the health care system.[19] Identifying these barriers is important from the standpoint of health services delivery, as eliminating modifiable barriers to care may ultimately improve health outcomes for Canadians with chronic disease.

Preliminary studies have shown that respondents with chronic medical conditions are more likely to report a perceived unmet health care need—a commonly used indicator of inadequate access to care.[19–23] However, these studies have been limited by a broad definition of chronic disease and have not assessed whether the type or number of chronic conditions have an influence on reported barriers to care.[22] Furthermore, there is limited information on the types of unmet health care needs these populations experience. Given these knowledge gaps, the objectives of this study were to determine whether there is an association between chronic medical conditions and perceived unmet health care needs and, if an association does exist, to determine whether it varies by number and type of chronic conditions present.

Methods

Study population.

We obtained data from the 2001, 2003 and 2005 cycles of the Canadian Community Health Survey (CCHS), a national cross-sectional survey conducted by Statistics Canada. This survey provides self-reported estimates of health determinants, health status and health care utilization at the health region level. The target population of the CCHS is household residents aged 12 years and older in the 10 provinces and 3 territories, excluding those living on Indian reserves or Crown land, full-time members of the Canadian Forces, institutional residents, and some residents of remote areas of Canada. Details of the survey methodology have been previously published.[24] We limited our study population to adults (18 years of age and older).

Study variables

Chronic disease. Chronic medical conditions, as determined by self-report, were identified from a list of more than 20 different conditions within the CCHS. The 7 chronic medical conditions with the highest prevalence or impact on health care utilization, considered "chronic conditions of interest" by the Health Council of Canada, were identified for study.[2,3] The conditions were arthritis, chronic obstructive pulmonary disease (COPD) or emphysema, diabetes, heart disease, hypertension, mood disorders and stroke. Survey respondents with none of these 7 conditions were categorized as having no chronic disease, although they might have other chronic conditions defined within the CCHS. We further identified those with multiple chronic conditions by extracting the number of such conditions reported by each respondent.

Perceived unmet health care needs. Each respondent was asked, "During the past 12 months, was there ever a time when you felt you needed health care but didn't receive it?" If respondents answered yes to this initial question, they were prompted with a follow-up question: "Thinking of the most recent time, why didn't you get care?" Reasons for an unmet need were classified into 4 categories: accessibility, availability, acceptability or personal choice, as modified from a previously described classification system developed by Chen and Hou.[20] These categories were established to separate systemic from personal reasons for unmet needs, and to further identify issues related to an individual's assessment or evaluation of the system (i.e., acceptability) and issues related to personal circumstances and unrelated to the health care system (i.e., choice) (Appendix A).

Other variables of interest. Sociodemographic variables and health behaviours were based on the Health Behavior Model proposed by Anderson,[25] a framework to understand determinants that affect health services use and patient satisfaction. The framework includes predisposing factors, enabling factors, personal health choices, and health care system/environmental factors. With the components of this framework in mind, we considered the following variables: age, sex, marital status, education, household income, immigration status, residency type (urban or rural), aboriginal status, presence of a regular family doctor, perceived health status, body mass index (BMI), smoking and drinking status, and level of physical activity. Definitions for each variable are available on the Statistics Canada website (www.statcan.gc.ca/concepts/health-sante/index-eng.htm).

Statistical analysis. The proportion of respondents reporting an unmet health care need, and the 4 specific reasons for an unmet need, were compared across number of chronic conditions using χ^2 tests. The type of care required among respondents with an unmet need was also compared across number of chronic conditions. All descriptive statistics were weighted to reflect the Canadian population using sampling weights provided by Statistics Canada. When combining data from different CCHS cycles, we recalculated these sampling weights using an equation provided by Statistics Canada to account for the fact that respondents differed between cycles.[26] Finally, because of the multistage sampling methodology used in the CCHS surveys, bootstrapping techniques were used to obtain estimates of variance and confidence intervals (CI).

To determine the relationship between chronic disease and unmet health care needs, we used multivariate logistic regression with backward-selection techniques. We identified potential effect modifiers *a priori*, and interaction terms were developed for the interaction of chronic disease with age and with sex. Model fit was assessed by the likelihood ratio test. Odds ratio (OR) for unmet needs was calculated for respondents with at least one of the chronic diseases compared with those with no chronic disease (reference group), adjusting initially for age and sex only, and subsequently for sociodemographic variables, health behaviours, health status and survey cycle (to account for change over time). Age was categorized as 18–44 years, 45–64 years or ≥ 65 years; BMI was categorized as obese (≥ 30 kg/m²) or non-obese (< 30 kg/m²). For household income, the "missing" category was included in the model as a separate category because of the large number of respondents with missing data. Similar models were developed to assess the association between chronic disease and each reason for an unmet need (accessibility, availability, acceptability, personal choice) among respondents reporting an unmet need, as well as between number of chronic conditions (none, 1, 2 or 3 or more) and unmet needs. Because respondents with and without chronic medical conditions vary substantially in terms of demographic variables and health care need, sensitivity analyses were performed using varying reference categories. In the first analysis, the study population was limited to those with chronic conditions. Using respondents with 1 chronic condition as the reference category, we determined the effect of multiple chronic conditions on the odds of reporting an unmet need. A second sensitivity analysis limited the reference group to those with no chronic disease. (As mentioned earlier, "no chronic disease" excludes other chronic diseases defined within the CCHS but not of interest in this study). Finally, subgroup analyses were performed to determine whether similar associations were observed in hypertensive and diabetic populations.

For all statistical tests, $p < 0.05$ was considered statistically significant. All analyses were conducted at the Prairie Regional Data Centre in Calgary, Alberta, using STATA 11.0 (Statacorp, College Station, Tex.). This study was approved by the ethics review board of the University of Calgary, Calgary, Alberta, and by Statistics Canada.

Results

A total of 360 105 adult respondents from the 3 CCHS cycles were included in the analysis. The relative proportion of respondents with 1, 2 or 3 or more chronic conditions was 21.3%, 6.8% and 3.6%, respectively (Table 1). Respondents with chronic conditions were older, were more likely to be female, and had lower household incomes and education levels than those with no chronic conditions. Furthermore, the proportion of respondents with a regular family doctor was higher for adults with chronic conditions and increased with the number of chronic conditions reported. Arthritis and hypertension were the most commonly reported chronic conditions (prevalence 17.8% and 15.5%, respectively), followed by diabetes, heart disease and mood disorders (Appendix B).

Overall, 12.2% of adult respondents reported an unmet need (Table 2). The most commonly reported reason for an unmet need was related to availability (52%), followed by personal choice (32.1%). Generally, the proportion of unmet needs was significantly higher in respondents with chronic medical conditions than in those without and increased with the number of chronic conditions present (χ^2 and test for trend, $p < 0.001$).

Table 1
Respondent characteristics

Characteristic	Number of chronic conditions, n (%)					
	Total 360 105 (100)	None 217 350 (60.4)	1* 85 424 (23.7)	2 38 539 (10.7)	≥ 3 18 792 (5.2)	p value†
Male, %	49.0	51.4	45.3	42.0	43.5	< 0.001
Age, %						< 0.001
18–44 years	51.6	66.6	28.6	10.4	4.3	
45–64 years	32.6	27.4	45.2	41.1	35.2	
≥ 65 years	15.8	6.0	26.3	48.5	60.6	
Rural resident, %	18.1	17.3	19.7	20.1	20.2	< 0.001
Household income, %						< 0.001
< $50 000	9.0	9.0	9.3	8.6	8.2	
$50 000–60 000	8.8	9.2	8.4	7.6	6.2	
$60 000–80 000	14.6	16.0	13.3	10.1	7.7	
> $80 000	25.7	29.5	21.6	13.3	7.9	
Missing	41.9	36.4	47.3	60.3	70.1	
Marital status, %						< 0.001
Married/common-law	64.5	63.2	68.6	65.7	60.8	
Single	22.6	28.3	13.2	7.9	6.5	
Other	12.9	8.5	18.2	26.4	32.7	
Level of education, %						< 0.001
Less than high school	19.6	14.0	25.9	37.7	45.3	
High school graduate	18.9	19.6	18.3	16.9	14.6	
Some post-secondary	8.7	9.8	7.1	5.7	5.4	
Post-secondary graduate	52.8	56.6	48.8	39.7	34.6	
Obese (BMI‡ ≥ 30), %	15.2	11.5	19.2	27.6	33.3	< 0.001
Born outside of Canada, %	22.7	22.5	22.7	24.3	23.6	0.009
Aboriginal status, %	2.3	2.2	2.5	2.3	2.6	0.002
Have a regular family doctor, %	85.1	80.9	92.3	96.1	97.1	< 0.001
Perceived health, %						< 0.001
Excellent	22.9	29.8	12.2	4.0	1.4	
Very good/good	64.9	65.3	70.0	60.2	38.1	
Fair/poor	12.2	4.9	17.8	35.8	60.5	
Smoking status, %						< 0.001
Current	24.9	26.2	24.3	19.2	17.0	
Former	41.1	37.9	45.7	49.9	54.7	
Never	34.0	35.9	30.1	30.9	28.3	
Drinking status, %						< 0.001
Regular/occasional	81.0	84.3	78.6	69.3	59.3	
Former	12.1	9.1	14.8	21.7	30.2	
Never	6.9	6.6	6.6	9.0	10.5	
Physical activity level, %						< 0.001
Active	23.3	25.4	21.2	15.8	12.1	
Moderate	24.7	25.2	24.6	22.6	18.9	
Inactive	52.1	49.4	54.2	61.6	69.0	

* Chronic conditions include arthritis, chronic obstructive pulmonary disease/emphysema, diabetes, heart disease, hypertension, mood disorders and stroke
† p value for comparison of respondents with no chronic disease, 1, 2 or ³ 3 conditions (χ²)
‡ BMI = body mass index

Among respondents with 1 chronic condition, 14.0% reported an unmet need. This increased to 16.2% among respondents with 3 or more chronic conditions. There also appeared to be overall trends in the reason for the unmet need. However, these results should be interpreted with caution. Issues related to accessibility increased with the number of chronic conditions, while unmet needs related to personal choice decreased. Finally, among respondents who reported an unmet health care need (n = 44 618), 72.8% required care for a physical health problem (types of problems were physical health problem, emotional or mental problem, regular check-up, care of an injury, and other). The proportion of respondents requiring care for physical health problems also increased with the number of chronic conditions (Appendix C).

Overall association. Compared with respondents with no chronic disease, the presence of at least 1 chronic condition was associated with an increased likelihood of an unmet need (Table 3). In a model adjusted for sociodemographic and health status characteristics, respondents with a chronic condition were 1.5 times more likely to report an unmet need (OR 1.51, 95% CI 1.45–1.59). There was no evidence of effect modification by age or sex. Among respondents reporting an unmet need (n = 44 618), presence of 1 or more chronic conditions showed varying associations with the reason for the unmet need. Respondents with chronic disease were more likely to report issues related to availability (OR 1.14, 95% CI 1.06–1.22) and less likely to report barriers to care as a result of personal choice (OR 0.83, 95% CI 0.76–0.90), compared with those with no chronic disease.

Type of chronic condition. In analyses by type of condition, arthritis, heart disease and mood disorders were all associated with an increased risk of unmet need (Table 4). Respondents with mood disorders were almost twice as likely to report an unmet need (adjusted OR 1.94, 95% CI 1.78–2.12), whereas respondents with diabetes or hypertension were less likely to report an unmet need (OR 0.85, 95% CI 0.76–0.94 and OR 0.96, 95% CI 0.89–1.04, respectively).

Table 2
Proportion of respondents with perceived unmet health care needs by number of chronic medical conditions

| Characteristic | Number of chronic conditions, n (%) | | | | | p value* |
	Total 360 105 (100)	None 217 350 (60.4)	1* 85 424 (23.7)	2 38 539 (10.7)	≥ 3 18 792 (5.2)	
% with unmet need	12.2	11.2	14.0	13.6	16.2	< 0.001
Reason for unmet need †						< 0.001
Accessibility, %	11.7	10.8	12.3	13.9	14.4	
Availability, %	52.0	50.0	53.9	58.0	55.7	
Acceptability, %	5.8	5.7	6.0	6.2	5.5	
Personal choice, %	32.1	35.3	28.5	24.5	25.1	

*p value for comparison of respondents with no chronic disease, 1, 2 or ³ 3 conditions (χ^2)
†Among respondents reporting an unmet health care need.

Table 3
Odds of an unmet health care need by presence (versus absence) of chronic condition

| Characteristic | Odds ratio (95% confidence interval) | | |
	Unadjusted	Age–sex adjusted	Multivariate adjusted
Chronic condition present†	1.31 (1.27–1.35)	1.88 (1.81–1.95)	1.51 (1.45–1.59)
Type of unmet need (n = 44 618)			
Accessibility	1.22 (1.12–1.34)	1.26 (1.14–1.40)	1.04 (0.92–1.17)
Availability	1.23 (1.16–1.30)	1.10 (1.03–1.17)	1.14 (1.06–1.22)
Acceptability	1.06 (0.94–1.19)	1.06 (0.92–1.21)	1.15 (0.99–1.32)
Personal choice	0.68 (0.66–0.71)	0.79 (0.73–0.86)	0.83 (0.76–0.90)

*Multivariate model adjusted for age, sex, household income, level of education, marital status, having a regular family doctor, perceived health status, Aboriginal status, immigration status and survey cycle
†At least one highly prevalent and high-impact chronic condition (arthritis, chronic obstructive pulmonary disease/emphysema, diabetes, heart disease, hypertension, mood disorder, stroke); reference group is respondents with no self-reported chronic medical conditions of interest

Number of chronic conditions. Number of chronic conditions also influenced the association between chronic disease and unmet health care needs. Respondents with 1 condition were 1.5 times more like to report an unmet need (OR 1.50, 95% CI 1.43–1.58) than those with no chronic conditions, whereas respondents with 3 or more conditions were 1.7 times more likely to report an unmet need (OR 1.71, 95% CI 1.56–1.88) (Table 5).

Sensitivity analyses. Analyses restricting the study population to those with chronic disease and using 1 chronic condition only as the reference showed similar results. Although slightly attenuated, the odds of an unmet need were higher among respondents with 2 chronic conditions (adjusted OR 1.11, 95% CI 1.04–1.17) and even higher in those with 3 or more conditions (adjusted OR 1.30, 95% CI 1.18–1.44). When we examined type of need among respondents with reported barriers to care, issues related to availability appeared to increase with the number of chronic conditions present. No trends were observed for need related to accessibility, acceptability or personal choice (Appendix D).

Our second sensitivity analysis using respondents with no chronic conditions as the reference category strengthened the association between chronic disease and unmet needs (adjusted OR 2.61, 95% CI 2.44–2.78). The odds of an unmet need also increased among respondents with 2 chronic conditions (OR 2.75, 95% CI 2.52–3.01) and with 3 or more conditions (OR 3.21, 95% CI 2.88–3.58).

Similar trends were observed in analyses restricted to those with hypertension (n = 68 301) and to those with

Table 4

Odds of an unmet health care need for selected chronic conditions

Chronic condition	Odds ratio (95% confidence interval)		
	Unadjusted	Age–sex adjusted	Multivariate adjusted*
Arthritis	1.44 (1.39–1.49)	1.98 (1.90–2.06)	1.51 (1.41–1.61)
COPD†/emphysema	1.57 (1.40–1.77)	2.06 (1.83–2.32)	1.19 (0.99–1.43)
Diabetes	0.96 (0.90–1.02)	1.24 (1.16–1.33)	0.85 (0.76–0.94)
Heart disease	1.17 (1.10–1.24)	1.75 (1.64–1.87)	1.16 (1.04–1.30)
Hypertension	0.91 (0.87–0.95)	1.20 (1.15–1.26)	0.96 (0.89–1.04)
Mood disorder	2.89 (2.71–3.07)	2.76 (2.59–2.94)	1.94 (1.78–2.12)
Stroke	1.29 (1.16–1.44)	1.86 (1.66–2.08)	1.16 (0.96–1.40)

*Multivariate model adjusted for age, sex, household income, level of education, marital status, having a regular family doctor, perceived health status, Aboriginal status, immigration status and presence of each comorbid chronic condition
† COPD = chronic obstructive pulmonary disease

Table 5

Odds of an unmet health care need by number of chronic conditions present

Number of chronic conditions*	Odds ratio (95% confidence interval)		
	Unadjusted	Age–sex adjusted	Multivariate adjusted†
1	1.29 (1.25–1.34)	1.73 (1.66–1.80)	1.50 (1.43–1.58)
2	1.25 (1.20–1.32)	2.16 (2.04–2.28)	1.52 (1.41–1.62)
3	1.54 (1.44–1.65)	3.06 (2.89–3.30)	1.71 (1.56–1.88)

*Chronic conditions include arthritis, chronic obstructive pulmonary disease/emphysema, diabetes, heart disease, hypertension, mood disorders and stroke; reference group is respondents with no self-reported chronic medical conditions of interest
† Multivariate model adjusted for age, sex, household income, level of education, marital status, having a regular family doctor, perceived health status, Aboriginal status, immigration status and survey cycle

diabetes (n = 22 282). Compared with respondents with hypertension only, respondents with hypertension and 1 other condition were 1.4 times more likely to report an unmet need (OR 1.37, 95% CI 1.22–1.54), whereas respondents with hypertension and 3 or more additional chronic conditions were 2.3 times more likely to report unmet need (OR 2.33, 95% CI 1.92–2.83). Similar trends were observed among the respondents with diabetes (Appendix E).

Interpretation

Using a large, population-based survey of Canadians, we found that the presence of chronic conditions was associated with an increased risk of perceived unmet health care needs. Respondents with chronic conditions were 1.5 times more likely to report an unmet need, and the reasons were mainly related to resource availability. Furthermore, this association was influenced by the type and number of chronic medical conditions present among adult respondents.

Our findings complement those from previous studies using population-based survey data[19–23] showing that patients with chronic conditions have a higher proportion of unmet needs than those without. However, these studies used a broad definition of chronic disease, which included over 20 different conditions, and did not assess the independent effects of specific conditions on the association with unmet needs. A strength of our study was the ability to identify the differential effects of type and number of conditions on the odds of reporting an unmet need, as well as to further explore the association between reasons for unmet needs and type and number of conditions. We found that the proportion of respondents reporting perceived barriers to care changed with the number of reported chronic medical conditions. These novel results suggest there may be a cumulative effect of multiple conditions on reported barriers to care. These results also represent a conservative estimate of this effect, as demonstrated by our sensitivity analyses when we defined the reference group as the absence of chronic conditions.

Chronic care models have emphasized the importance of coordinated care within the health care system and improved self-care for management of chronic disease.[10,12,14,27] However, multiple conditions often make this task difficult, from both a system and patient perspective.[13,28–30] Bayliss and colleagues found that patients with multiple chronic conditions often report an overwhelming effect of a single disease condition, which interferes with their ability to appropriately manage other comorbid conditions.[28] They also found that increased distress from multiple conditions may decrease patients' ability to mobilize health care resources.[30] Given their greater need for coordinated and convenient care, patients with multiple conditions may have higher expectations for health care services, which in turn may explain the higher proportion of respondents with multiple conditions reporting barriers to care. Findings from our restricted analysis support the effect of concordant illnesses on unmet needs. Although diabetes and hypertension were not independently associated with barriers to care, the odds of an unmet need increased when these conditions were assessed in combination with others. Given that diabetes and hypertension represent 2 common conditions that often co-exist, these results highlight the complexity of comorbidity in primary care. These results also echo the body of literature suggesting a differential effect of concordant versus discordant illnesses on perceived barriers to care.[31,32]

The most commonly reported reason for an unmet need was related to service availability, confirming results of previous studies.[20,22,33] Although improving availability of care and decreasing service wait times continue to top the Canadian health care agenda, future work must determine whether disparities related to availability are associated with worse outcomes in populations with chronic disease, and whether interventions targeted to address these needs ultimately improve outcomes. The fact that respondents with chronic medical conditions are more likely to have a family doctor than those with no chronic conditions suggests that the issue is not access to primary health care, but rather the quality or quantity of care they are receiving. Our analysis of the type of care required supports this claim. Not surprisingly, we found that the proportion of care related to physical health problems increased in the presence of multiple chronic conditions. Kasman has proposed that lengthy wait times to see specialists may explain why barriers related to availability increase with number of chronic diseases.[21] This conclusion is further supported by results from the International Health Policy Survey of Sicker Adults, which shows that respondents with chronic disease experience longer wait times for specialist appointments in Canada than in 7 other countries.[34]

Furthermore, when considering disease type, respondents with mood disorders and arthritis had an increased likelihood of an unmet health care need, while those with diabetes and hypertension did not. This may be related to the symptomatic nature of arthritis and mood disorders, resulting in a perceived unmet need. It

has been suggested that, because there are fewer treatment options for conditions involving pain and subjective symptoms, treatment may fail to meet the patient's expectations for symptomatic and functional changes, leading to frustration and negative attitudes toward the health care system.[21,35]

Our study should be interpreted in light of its limitations. First, variables for exposure and outcome were obtained from self-reported survey data, and thus, there are issues related to their reliability and validity. Second, potential barriers to care were defined using one question in the CCHS about unmet needs, which respondents may have interpreted various ways. Specifically, a negative response might indicate that the respondent felt he or she had no need for health care, or that he or she needed care but endured a lengthy wait for care.[21,23] Despite this limitation, we have no reason to believe interpretation of this question would differ by type of chronic condition. Third, with respect to the reasons for reporting an unmet need, understanding the differential associations between the type of chronic condition and the reason for unmet need is important from a policy perspective. Interestingly, we found that respondents with chronic conditions were less likely to report an unmet need related to personal choice. Exploring whether this association is related to self-management, disease severity or attitudes towards the health care system remains an important area for future research. Finally, we limited our definition of chronic disease to the 7 most highly prevalent, high-impact chronic medical conditions, which may affect the generalizability of these findings. Given the differential impact we observed among the 7 selected conditions included in our study, further work is the required to determine whether other chronic conditions or disease severity negatively affect access to care.

In summary, our study provides a national perspective on the potential gaps in care for Canadians with chronic disease. With the use of a large population-based sample, we demonstrate that adults with chronic conditions, and in particular those with multiple conditions are more likely to report a perceived barrier to care. Given the increasing prevalence of chronic disease in the population, future studies should focus on clarifying the types of unmet health care needs these groups experience as well as the impact of these unmet needs on health outcomes and on future requirements for more acute care services. These results represent important first steps to ultimately improve management and health outcomes for the millions of Canadians living with chronic disease.

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Categorization of types of unmet need

Accessibility (barriers that restrict the entry into or use of health care resources)
    Cost
    Transportation

Availability (perceived deficiencies in health care delivery that inhibit a person's ability to receive care)
    Waiting time too long
    Not available when requested
    Not available in area

Acceptability (personal attributes and attitudes related to the health care system)
    Dislike doctor/afraid
    Language problems
    Didn't know where to go

Personal choice (attitudes and competing responsibilities not related to the health care system)
    Too busy
    Didn't get around to it/didn't bother
    Felt it would be inadequate
    Decided not to seek care
    Personal/family responsibilities

Appendix B
Proportion (%) of respondents with selected chronic medical conditions

Arthritis	17.8
COPD*/emphysema	1.4
Diabetes	5.0
Heart disease	5.4
Hypertension	15.5
Mood disorder	5.8
Stroke	1.2

*COPD = chronic obstructive pulmonary disease

Appendix C
Type of care required by number of chronic medical conditions among respondents reporting an unmet health care need

	Number of chronic conditions, n					
Type of care required	Total 44 618	None 24 886	1 11 547	2 5167	≥ 3 3018	p value*
Treatment of a physical health problem, %	72.8	72.1	72.9	75.1	78.1	< 0.001
Treatment of an emotional or mental health problem, %	8.7	7.2	11.3	11.3	10.0	< 0.001
Regular check-up, %	8.3	9.6	6.6	5.6	5.5	< 0.001
Care of an injury, %	7.7	8.6	7.3	5.6	3.4	< 0.001
Other, %	7.6	7.4	7.5	8.1	9.4	< 0.001

*p value for comparison of respondents with no chronic disease, 1, 2 or ≥ 3 conditions (χ^2)

Appendix D

Type of need by number of chronic medical conditions* among respondents reporting an unmet health care need (n = 44 618)

Type of need; number of chronic conditions†	Odds ratio (95% confidence interval)		
	Unadjusted	Age–sex adjusted	Multivariate adjusted‡
Accessibility			
1	1.16 (1.04–1.29)	1.19 (1.06–1.34)	1.06 (0.93–1.22)
2	1.33 (1.15–1.54)	1.42 (1.21–1.67)	1.02 (0.85–1.22)
≥ 3	1.39 (1.17–1.65)	1.52 (1.25–1.86)	1.05 (0.83–1.33)
Availability			
1	1.17 (1.09–1.25)	1.08 (1.01–1.15)	1.10 (1.02–1.18)
2	1.38 (1.26–1.51)	1.20 (1.08–1.33)	1.26 (1.13–1.41)
≥ 3	1.25 (1.11–1.42)	1.07 (0.93–1.23)	1.17 (1.00–1.35)
Acceptability			
1	1.06 (0.93–1.21)	1.06 (0.91–1.22)	1.06 (0.91–1.24)
2	1.10 (0.89–1.35)	1.09 (0.87–1.37)	1.05 (0.83–1.34)
≥ 3	0.97 (0.77–1.21)	0.97 (0.73–1.27)	0.89 (0.67–1.18)
Personal choice			
1	0.82 (0.75–0.89)	0.82 (0.75–0.89)	0.86 (0.79–0.94)
2	0.72 (0.65–0.81)	0.72 (0.65–0.81)	0.81 (0.71–0.91)
≥ 3	0.78 (0.65–0.91)	0.78 (0.67–0.91)	0.89 (0.76–1.05)

*Chronic conditions include arthritis, chronic obstructive pulmonary disease/emphysema, diabetes, heart disease, hypertension, mood disorders and stroke.
†Reference group is respondents with no chronic conditions.
‡Multivariate model adjusted for age, sex, household income, level of education, marital status, having a regular family doctor, perceived health status, Aboriginal status, immigration status and survey cycle.

Appendix E

Odds of an unmet health care need by number of additional chronic conditions present among respondents with hypertension or diabetes

Chronic condition*	Odds ratio (95% confidence interval)		
	Unadjusted	Age–sex adjusted	Multivariate adjusted†
(n = 68 301)			
Hypertension only	Reference	Reference	Reference
Hypertension + 1	1.26 (1.15–1.38)	1.60 (1.45–1.76)	1.37 (1.22–1.54)
Hypertension + 2	1.58 (1.41–1.76)	2.23 (1.99–2.51)	1.52 (1.32–1.75)
Hypertension + 3 or more conditions	2.49 (2.13–2.91)	3.67 (3.12–4.33)	2.33 (1.92–2.83)
(n = 22 282)			
Diabetes only	Reference	Reference	Reference
Diabetes + 1	1.13 (0.95–1.34)	1.43 (1.19–1.70)	1.15 (0.94–1.41)
Diabetes + 2	1.41 (1.18–1.68)	2.11 (1.74–2.55)	1.48 (1.19–1.84)
Diabetes + 3 or more conditions	2.34 (1.90–2.87)	3.65 (2.92–4.56)	2.39 (1.83–3.13)

*Chronic conditions include arthritis, chronic obstructive pulmonary disease/emphysema, diabetes, heart disease, hypertension, mood disorder and stroke
†Multivariate model adjusted for age, sex, household income, level of education, marital status, having a regular family doctor, perceived health status, Aboriginal status and survey cycle